alpha® DFM 5/868

User Manual

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Information regarding the used trademarks
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Safety precautions

Attention!

- **The relevant regulations for installation and operation of electrical installations have to be observed (e. g. RL 1999/92/EG, RL94/9EG, ElexV, IEC/EN 60 079-14 and VDE 0100).**
- **The operator of an electrical installation in an explosion-endangered environment has to keep the equipment in proper condition, duly operate it, control it and carry out maintenance as well as repair works (ElexV and EN 60 079-14).**
- **The detailed knowledge and the technically correct realization of the installation guidelines, safety precautions and functions described in this user manual are essential to the safety of the operation.**
- **The safety of the product requires an appropriate transport, an appropriate storage, installation and operation.**
- **Intervention in the product may only be made by qualified personnel that is familiar with the user manual.**
- **When observing the handling instructions and the safety-related instructions, no dangers regarding damages to properties and to persons come from the product in normal case.**
- **Only use the unit for the allowed application. Mind the EC-type examination certificate.**
- **Faulty or improper use as well as the noncompliance with the instructions of this user manual exclude a warranty by the manufacturer.**

ESD protection measures

Comply with the ESD protection measures according to DIN EN 61340-5-1/2 when opening the unit (potential equalization between body and ground of the unit as well as ground of the casing via high-value resistance (approx. 1 MOhm) e. g. by means of a usual wrist band).

The following regulations have to be observed:

- **national safety regulations**
- **national rules for the prevention of accidents**
- **national regulations for mounting and installation**
- **generally approved rules of the technique**
- **safety precautions of this user manual**
- **characteristic values and measuring operating conditions of the type and data plates**
- **additional signboards on the unit**

Avoid to touch conductive parts of the unit.

Do not open the unit, only permit repairs by the manufacturer.

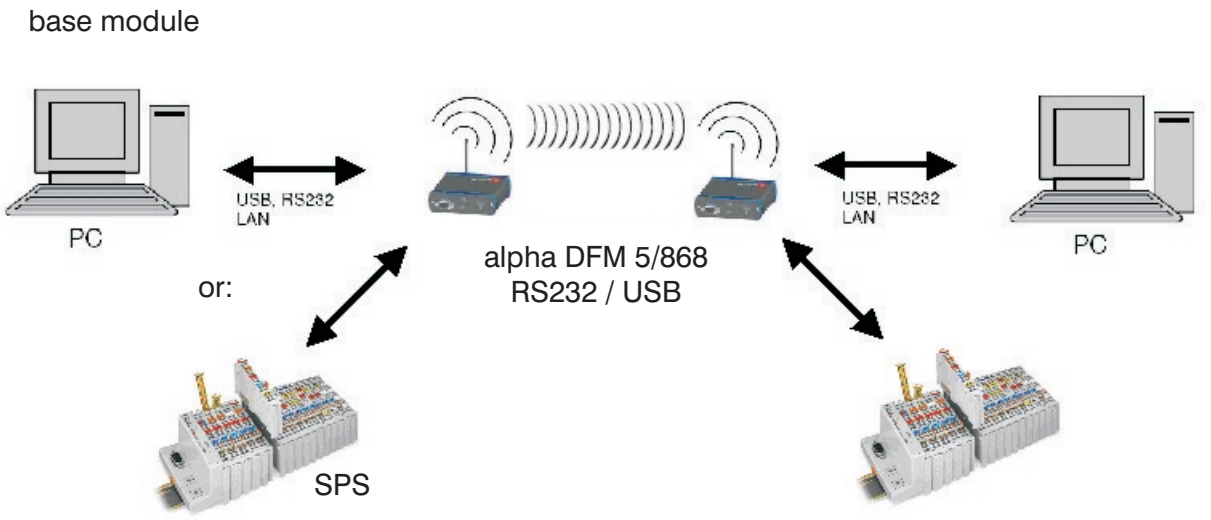
Mind the valid legal provisions for the protection of persons in electromagnetic fields when installing the antenna.

Read the user manual carefully to be able to use the wealth of features of your new alpha DFM 5/868.
You can also find further information on our website http://www.fmncom.com.

General product description

By means of two radio modems alpha DFM 5/868, a transparent RS232 track (half-duplex) can be set up. Therefore, a very simple cable replacement can be realized. Within the first 60 seconds after connection of the power supply, the configuration mode can be activated in which different parameters of the unit can be set by means of a terminal program.

The following picture shows an example:



Advantages:

- high data rate up to 50 kbits/s [1)]
- high range up to approx. 400 m [1)]
- very simple operation and configuration
- point-to-point and point-to-multipoint connection (addressing)
- secured or unsecured transmission
- possibility to connect an external antenna
- interface RS232, USB (optional LAN)

[1)] higher data rates or higher range on request

General product description

Possible applications

- Cable replacement for the serial interface (RS232), USB (Host to Host) and optional LAN (virtual COM-Port driver)
- M2M Machine to Machine (data communication of machines, vehicles, containers, automatic machines or other objects with a central control point)
- Traffic management systems (bus stop information)
- Transmission of measured values

Functional elements

The radio module is an interface between a radio channel and an RS232 or USB connection. This connection can e. g. be realized at a PC, an SPS or other objects with a central control point or at external units. Connections over RS232 and USB are available for this.

There are two LEDs at every radio module. The green LED indicates the operation of the module (glowing when the module is active) and the red LED indicates correctly transmitted and received packets of data.

Status LED (red) glowing for approx. 50 ms: packet of data transmitted correctly
Status LED (red) glowing for approx. 500 ms: packet of data received correctly

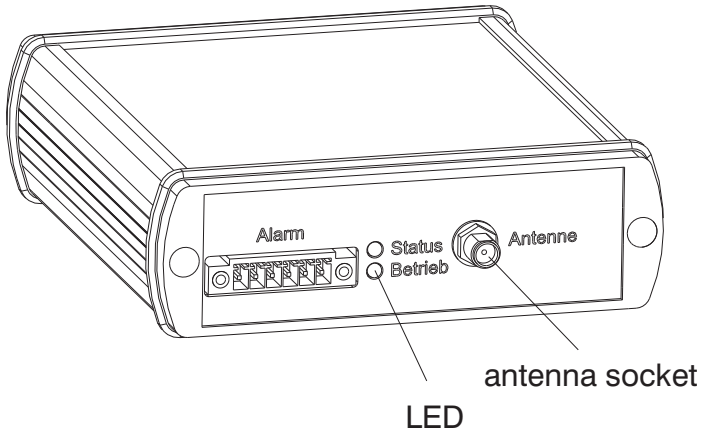


Fig.1: Functional elements FM LED and antenna sockets

PIN	Designation	Function
X.1	Interior contact	signal
X.2	External contact	ground

Table 1: Assignment of the antenna socket

LED	Colour	Function
	red	status
	green	operation

Table 2: Assignment of the LEDs

Interfaces

The power supply is possible via the USB interface. Alternatively, the power supply can also be realized over a power supply unit.

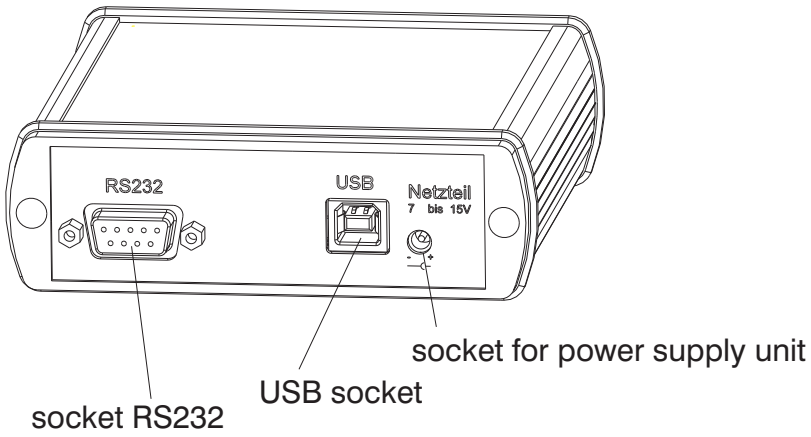


Fig. 2: Functional elements RS232 socket, USB socket and socket for power supply unit

PIN	Designation	Function
X.1	N.C.	not connected
X.2	RXD	received data
X.3	TXD	transmission data
X.4	N.C.	not connected
X.5	GND	ground
X.6	N.C.	not connected
X.7	RTS	transmitting request data
X.8	CTS	receiving readiness data
X.9	N.C.	not connected

Table 3: PIN assignment of the RS232 socket

PIN	Designation	Function
X.1	VCC	+5 V supply voltage
X.2	D-	data
X.3	D+	data
X.4	GND	ground

Table 4: PIN assignment of the USB socket

PIN	Designation	Function
X.1	Interior contact	positive supply voltage
X.2	External contact	ground

Table 5: PIN assignment of the power supply unit socket

Putting into operation

Delivery status

The parameters of the radio module alpha DFM 5/868 are set to the following values ex works:

- data rate: 115.200 baud, 8 data bits, no parity bit, 1 stop bit and protocol RTS / CTS Handshake (see chapter “Setting the RS232 interface or settings at the terminal program”)
- myaddr: 0
- destaddr: Broadcast operation (unconfirmed transmission)
- paclen: 245
- freq: 6
- retry: 15

By means of the command “restoredefault”, this delivery status can be restored.

Putting the radio module into operation

In order to be able to transmit data for first testing purposes by means of a terminal program (e. g. Hyperterminal), just the above mentioned interface parameters have to be set at the computer. Further configurations are not necessary in normal case.
Basically, you have to differentiate between pure data operation (Transparent mode) and command operation (Command Mode). In data operation, the data exchange is realized between the single radio sets. In command operation, for example the frequency of the radio set, the addressing and the interface parameters can be programmed.
The unit is in data mode immediately after connection of the operating voltage. This means, data can be transmitted immediately. But within the first 60 seconds after connection of the power supply, you can also switch to command operation for configuration purposes.

In command mode, the interface parameters can be set. In this mode, no data transmission is possible. By means of the Exit command, the command mode is left and data may be transmitted immediately.

To be able to make settings at the alpha DFM radio modem via a terminal program, the following settings of the interface (default values) have to be selected:

```
115200 - 8 - N - 1 RTS / CTS-Handshake.
```

For RS232 operation, no software settings are necessary.
To be able to use the USB interface (virtual Com-Port), the provided driver has to be installed.
(see chapter “Setting the USB interface”)

Modi:

Command Mode	—>	setting all device parameters (see possible settings)
Transparent Mode	—>	transparent data transmission by radio with data protocol, confirmed or unconfirmed transmission (CRC & Ack)

Possible settings

Possible settings in command mode

RS232 parameters:

Data bits 7 or 8

Stop bits 1 or 2

Parity NO, ODD, EVEN

Baud rate 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 76800 and 115200

Protocol HW or NO

User data length:

from 1 byte up to max. 245 byte

Destination address:

Address range from 1 up to 65023 for point-to-point connections (confirmed, secured transmission)

Broadcast (unconfirmed, secured transmission “BR=ON”, see chapter “Commands in Command Mode”)

Own address:

Address range from 1 up to 65023

Frequency:

Channel 1 up to 6

Max. number of packet repetitions:

1 up to 15 or unlimited

Modes of the radio module

Only within the first 60 seconds after connection of the power supply, it is possible for the user to change to command mode. Within this period, the user has to – before other data can be transmitted – press the keys “Control” “C” or to send the control character 0x03, then the radio module switches to Command Mode. In the terminal program, the device message (version and serial number) as well as an input prompt then appear.
Now, all important parameters can be read out and be configured newly, if necessary (see in the following chapter “Commands in Command Mode”).
By entering “exit”<CR>, the radio module changes to Transparent Mode and is now ready to transmit and receive.

At the same time, all changed parameters are saved and afterwards taken over and executed.

Commands in command mode

Command	Meaning	Possibilities
Config <CR>	Currently set parameters are displayed	Listing of the following parameters: Baudrate Databits Stopbits Parity Protocol Myaddr Destaddr Paclen Freq
Baudrate=<Baudrate><CR>	Setting baud rate	e. g. Baudrate=38400<CR> adjustable baud rates are: 1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 76800 or 115200
Databits=<Databits><CR>	Setting data bits	e. g. Databits=8<CR> 7 or 8 data bits adjustable
Stopbits=<Stopbits><CR>	Setting stop bits	e. g. Stopbits=1<CR> 1 or 2 stop bits adjustable
Parity=<Parity><CR>	Setting parity	e. g. Parity=NO<CR> NO, ODD or EVEN
Protocol=<X><CR>	Handshake of the RS232 interface	X=HW (hardware / RTS-CTS) X=NO (no handshake)
Myaddr=<X><CR>	Setting own address for the connection oriented operation	e. g. Myaddr=1<CR>
Destaddr=<destination address><CR>	Setting destination address	e. g. Destaddr=65023<CR> possible destination addresses can be 1 to 65023
Paclen=<user data length><CR>	Indication of the user data lenght (Payload) in byte	e. g. Paclen=245<CR> 1 up to max. 245 byte user data length adjustable
Freq=<channel number><CR>	Setting the der transmitting and receiving frequency	e. g. Freq=6<CR> channel 1 to 6 selectable
Exit<CR>	Saving the current configuration and leaving the Command Mode	Ends the command mode and changes to transparent mode, it is only possible to send and to receive data in this mode
Retry=<W><CR>	Max. number of packet repetitions in connection-oriented operation	W=1 ... 15 W=NO LIMIT: unlimited
Br=<X><CR>	Broadcast operation on / off	X=ON: Broadcast operation on (no confirmation) X=OFF: connection oriented operation (P2P, confirmed transmission)
Restoredefault<CR>	Restoring default settings	

Table 6: Command syntax and semantics

Possible settings

Usable frequencies

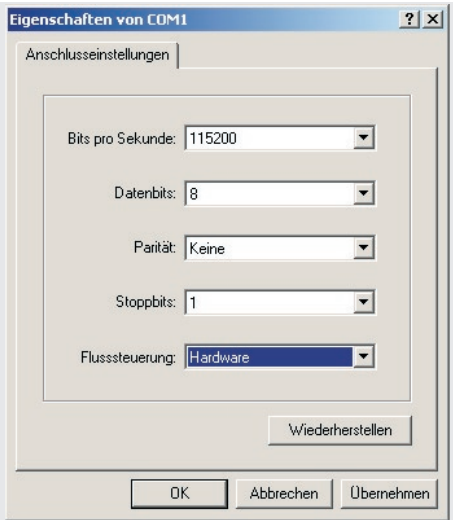
Channel number	Frequenzy range in MHz
1	868.150
2	868.450
3	868.825
4	869.075
5	869.525
6	869.850

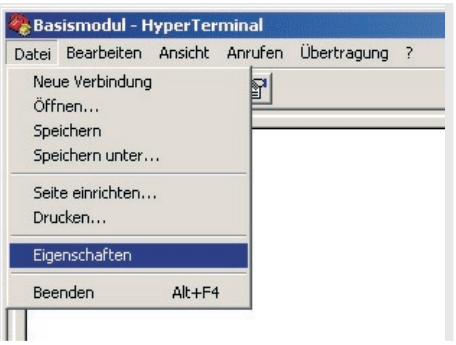
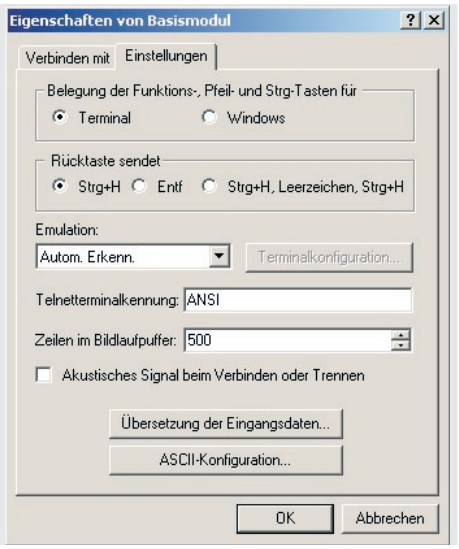
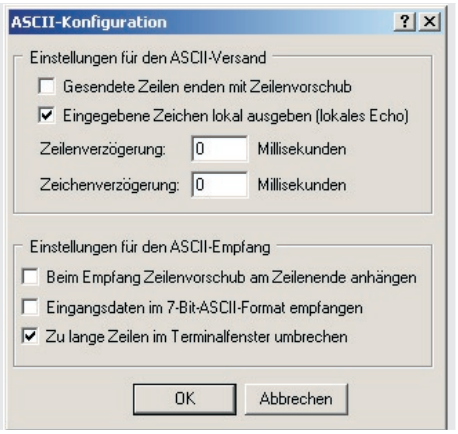
Table 7: Adjustable operating frequencies of the radio modules

Setting the interfaces

Setting the RS232 interface or settings at the terminal program

In case your computer has a free COM-Port (9-pole), you can use this connection for the connection with the radio module. Then it will not be necessary to install additional drivers.
The parametrisation can be done with any terminal program.
The manufacturer recommends to use the program Hyperterminal from Microsoft Windows.

1.	Start the programme Hyperterminal via: Start → Programme → Zubehör → Kommunikation → Hyperterminal Enter a name for the connection that is to be established anew. Here e. g. “Basismodul” (base module).	
2.	Select the COM-interface of the computers to which the alpha® DFM radio module connected.	
3.	Carry out the following settings Datenrate (data rate): 115200 Bit/s Datenbits (data bits): 8 Bit Parität (parity): keine (none) Stop-bits (Stopp bits): 1 Bit Flusssteuerung (flow control): Hardware	

4.	Select the menu item “Eigenschaften” (properties) under “Datei” (file).	
5.	Select the item ”Einstellungen” (Settings) and click on the button ”ASCII-Konfiguration” (ASCII configuration).	
6.	In the window ASCII-Konfiguration (ASCII configuration), make the following settings: ASCII-Versand - Eingegebene Zeichen lokal - Zeilenverzögerung: 0 ms - Zeichenverzögerung: 0 ms ASCII-Empfang - Überlange Zeilen im Terminalfenster umbrechen	

After confirming the options, the terminal program is ready to send and to receive.
When using another terminal program, the settings have to be carried out like explained in the example of the Hyperterminal program.

Setting the USB interface

In case your PC is equipped with an USB interface, you can use this connection for the connection with the radio module. Install the supplied USB driver as described following.

Automatic USB driver installation

1. Connect the radio module alpha DFM 5/868 with the computer by means of an USB cable. A message about newly found hardware is displayed. If this is not the case, please read the chapter “Manual USB driver installation”.

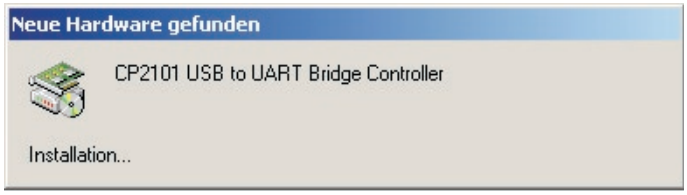


Fig. 3: New hardware found

2. Click on “Weiter” (Next) in the next window.

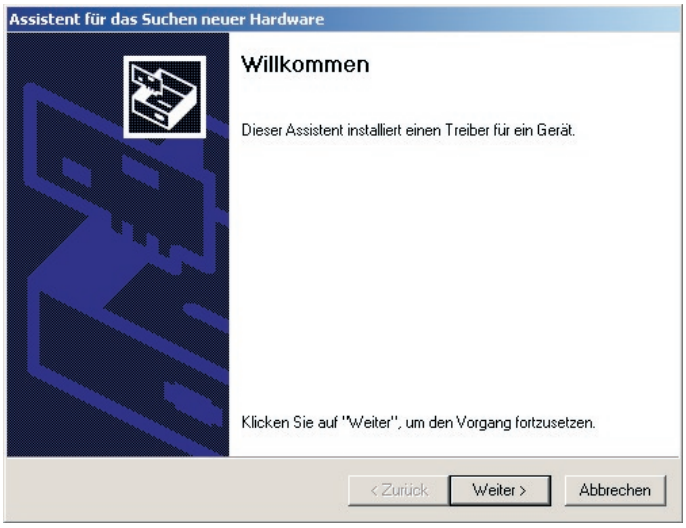

Assistent für das Suchen neuer Hardware
Willkommen
Dieser Assistent installiert einen Treiber für ein Gerät.
Klicken Sie auf "Weiter", um den Vorgang fortzusetzen.
< Zurück
Weiter >
Abbrechen

Fig. 4: Assistant for searching new hardware

3. Click on “Weiter” (Next) in the next window.

Assistent für das Suchen neuer Hardware
Hardwaretreiber installieren
Ein Gerätetreiber ist ein Programm, das das Ansprechen des Geräts durch das Betriebssystem ermöglicht.
Der Assistent wird die Installation des Geräts fertig stellen:
CP2101 USB to UART Bridge Controller
Gerätetreiber sind Programme zum Steuern der Hardware. Für das neue Gerät sind Treiberdateien erforderlich. Klicken Sie auf "Weiter", um diese Treiberdateien zu suchen und die Installation zu abzuschließen.
Wie möchten Sie vorgehen?
Nach einem passenden Treiber für das Gerät suchen (empfohlen)
Alle bekannten Treiber für das Gerät in einer Liste anzeigen und den entsprechenden Treiber selbst auswählen
< Zurück
Weiter >
Abbrechen

Fig. 5: Assistant for searching new hardware, install driver

4. Click on “Weiter” (Next) in the next window.

Assistent für das Suchen neuer Hardware
Suche nach Treiberdateien
Geben Sie an, wo nach den Treiberdateien gesucht werden soll.
Nach Treiberdateien für folgende Geräte suchen:
CP2101 USB to UART Bridge Controller
Der Assistent sucht in der Treiberdatenbank und auf den angegebenen Laufwerken nach passenden Treibern.
Klicken Sie auf "Weiter", um die Suche zu starten. Wenn der Suchvorgang auf einer Diskette oder einem CD-ROM-Laufwerk ausgeführt wird, legen Sie zuvor den Datenträger ein.
Andere Quellen für die Suche:
Diskettenlaufwerke
CD-ROM-Laufwerke
Andere Quelle angeben
Microsoft Windows Update
< Zurück
Weiter >
Abbrechen

Fig. 6: Select driver source

The driver is now searched on the supplied CD and installed.

5. Click on “Weiter” (Next) in the next window.

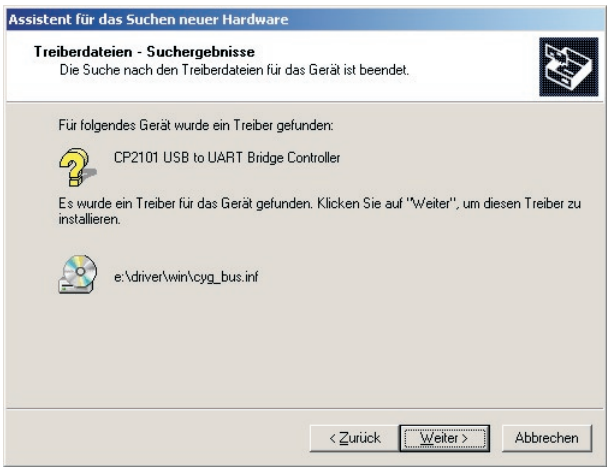

Assistent für das Suchen neuer Hardware
Treiberdateien - Suchergebnisse
Die Suche nach den Treiberdateien für das Gerät ist beendet.
Für folgendes Gerät wurde ein Treiber gefunden:
CP2101 USB to UART Bridge Controller
Es wurde ein Treiber für das Gerät gefunden. Klicken Sie auf "Weiter", um diesen Treiber zu installieren.
e:\driver\win\cyg_bus.inf
< Zurück
Weiter >
Abbrechen

Fig. 7: Driver files found

6. Click on “Fertig stellen” (Finish) in the next window.

Assistent für das Suchen neuer Hardware
Fertigstellen des Assistenten
Cygnal USB Composite Device
Die Software für das Gerät wurde installiert.
Klicken Sie auf "Fertig stellen", um den Vorgang abzuschließen.
< Zurück
Fertig stellen
Abbrechen

Fig. 8: Finish driver installation

With this step, the driver installation is finished.

Setting the USB interface

Manual USB driver installation

In case you see the following symbol down right in the corner of the screen after connecting the radio module alpha DFM 5/868 and the dialogue for installing the USB driver does not appear, the USB hardware of the radio module was not detected automatically.

Fig 9: USB hardware that was not detected

You can install the required driver manually with the following steps:

1. Open the device manager with:
   START → Einstellungen → Systemsteuerung → System → Hardware → Geräte-Manager.

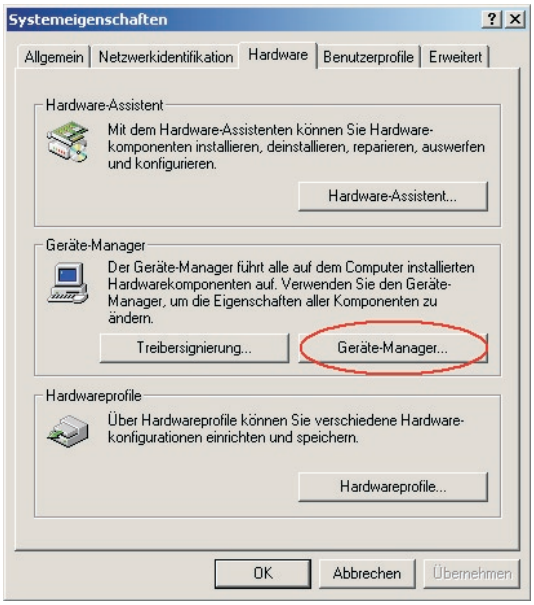


Fig. 10: Open device manager

2. Open the properties dialogue of the unit "CP2101 USB to UART Bridge Controller" by a double-click. This is marked by a yellow exclamation mark.

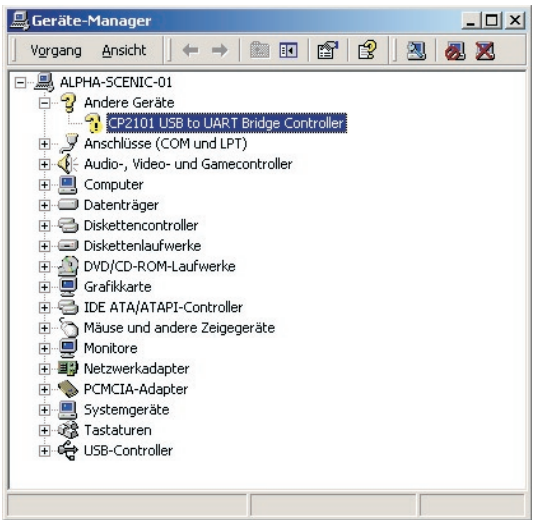


Fig 11: Open properties dialogue

3. Click on "Treiber erneut installieren…" (Install driver again...) in the properties dialogue.

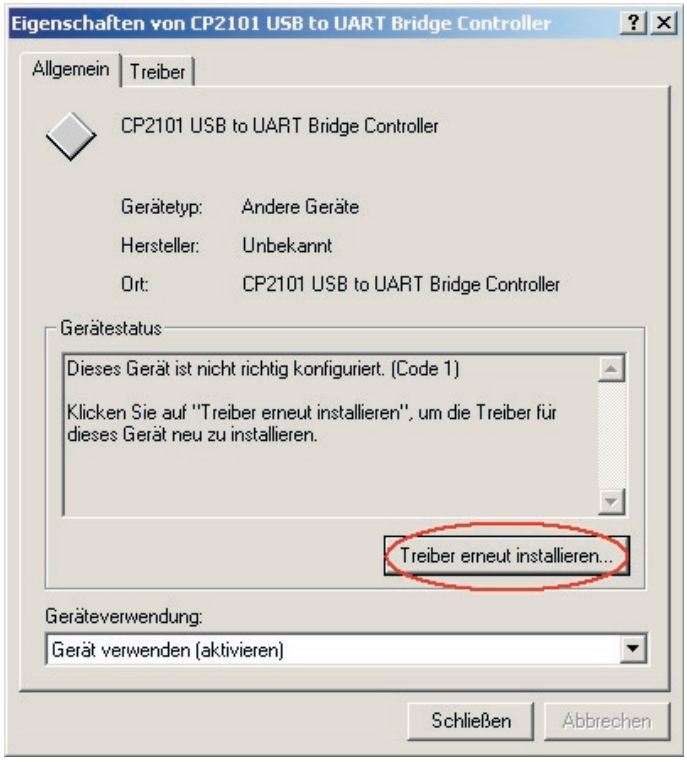

Eigenschaften von CP2101 USB to UART Bridge Controller
Allgemein
Treiber
CP2101 USB to UART Bridge Controller
Gerätetyp: Andere Geräte
Hersteller: Unbekannt
Ort: CP2101 USB to UART Bridge Controller
Gerätestatus
Dieses Gerät ist nicht richtig konfiguriert. (Code 1)
Klicken Sie auf "Treiber erneut installieren", um die Treiber für dieses Gerät neu zu installieren.
Treiber erneut installieren...
Geräteverwendung:
Gerät verwenden (aktivieren)
Schließen
Abbrechen

Fig.12: Properties dialogue, install driver again

4. Click on “Weiter” (Next) in the next window.

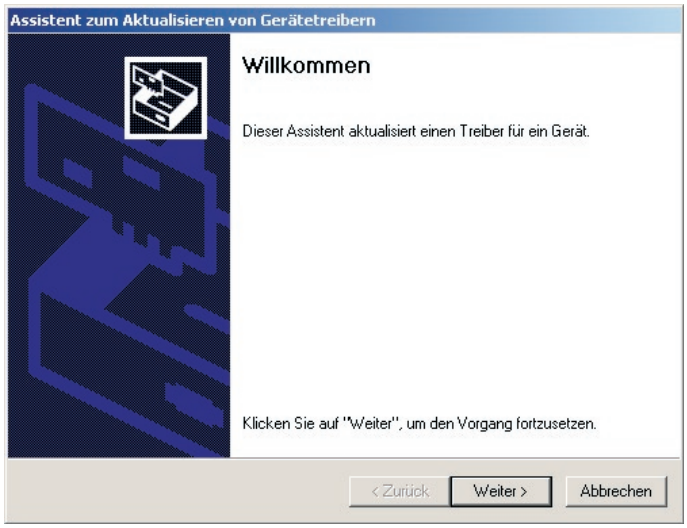

Assistent zum Aktualisieren von Gerätetreibern
Willkommen
Dieser Assistent aktualisiert einen Treiber für ein Gerät.
Klicken Sie auf "Weiter", um den Vorgang fortzusetzen.
< Zurück
Weiter >
Abbrechen

Fig. 13: Assistant for updating device drivers

5. Click on “Weiter” (Next) in the next window.

Assistent zum Aktualisieren von Gerätetreibern
Hardwaretreiber installieren
Ein Gerätetreiber ist ein Programm, das das Ansprechen des Geräts durch das Betriebssystem ermöglicht.
Der Assistent aktualisiert die Treiber für folgendes Gerät:
CP2101 USB to UART Bridge Controller
Beim Aktualisieren eines Treibers wird der Funktionsumfang des Geräts erweitert oder dessen Leistung optimiert.
Wie möchten Sie vorgehen?
Nach einem passenden Treiber für das Gerät suchen (empfohlen)
Alle bekannten Treiber für das Gerät in einer Liste anzeigen und den entsprechenden Treiber selbst auswählen
< Zurück
Weiter >
Abbrechen

Fig.14: Assistant for searching new drivers

6. Insert the supplied CD into the CD-ROM drive.

Select "CD-ROM-Laufwerke" (CD-ROM drives) as source for the driver search.
Click on "Weiter" (Next).

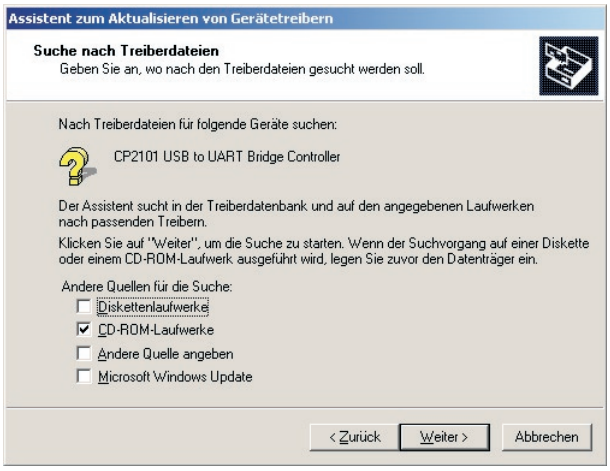

Assistent zum Aktualisieren von Gerätetreibern
Suche nach Treiberdateien
Geben Sie an, wo nach den Treiberdateien gesucht werden soll.
Nach Treiberdateien für folgende Geräte suchen:
CP2101 USB to UART Bridge Controller
Der Assistent sucht in der Treiberdatenbank und auf den angegebenen Laufwerken nach passenden Treibern.
Klicken Sie auf "Weiter", um die Suche zu starten. Wenn der Suchvorgang auf einer Diskette oder einem CD-ROM-Laufwerk ausgeführt wird, legen Sie zuvor den Datenträger ein.
Andere Quellen für die Suche:
Diskettenlaufwerke
CD-ROM-Laufwerke
Andere Quelle angeben
Microsoft Windows Update
< Zurück
Weiter >
Abbrechen

Fig. 15: Select the source for the driver

7. Finish the installation with "Fertigstellen" (Finish).

Assistent zum Aktualisieren von Gerätetreibern
Fertigstellen des Assistenten
Cygnal USB Composite Device
Die Software für das Gerät wurde installiert.
Klicken Sie auf "Fertig stellen", um den Vorgang abzuschließen.
< Zurück
Fertig stellen
Abbrechen

Fig. 16: Finish the manual driver installation

If you can still see a yellow exclamation mark in the device manager, please carry out the instructions of this chapter a second time.

Setting the USB interface

Checking the USB driver settings

To check the correct installation of the USB driver, please proceed as follows and open:

1. Start → Einstellungen → Systemsteuerung → System → Hardware → Gerätemanager
2. Click on the "+" in front of "Anschlüsse (COM und LPT)" (Connections (COM and LPT))

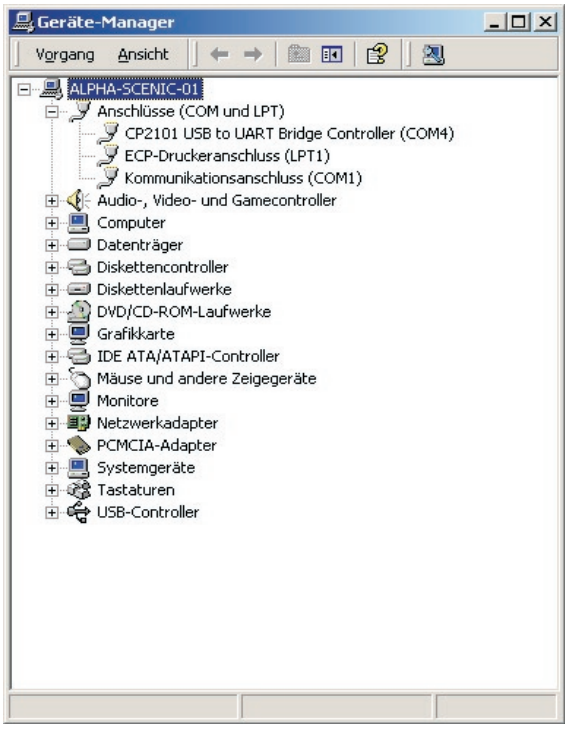


Fig.17: Device manager

3. Twice click on the entry: "CP2101 USB to UART Bridge Controller (COMx)".

A new COM-Port (COMx) should be entered here now. The "x" stands for the respective COM-Port that has to be set, e. g. COM2.

4. Then select the button "Anschlusseinstellungen".
5. Check the following settings:

bits per second:	115200
data bits:	8
parity:	none
stop bits:	1
flow control:	hardware (CTS / RTS)

6. Close the window and terminate the device manager.

If all installations are correct, a new COM-Port for the communication with the radio module is available now.

Antennas

When visibility is clear, ranges of up to 400 m are possible by means of standard antennas between the modules.
By means of a gain antenna, receiving and transmitting
properties of the wireless measurement system can be improved.
All antennas for the ISM band 868 MHz can be used in principle. Omnidirectional antennas with an antenna gain > 0 dBi are recommended. When purchasing an antenna, mind the required SMA plug at the connection cable.
The antenna radiator may in no case touch conductive parts (e. g. plates, heaters, cable, PC housings, etc.) or be shielded by these.
If possible, there should be a visual contact to the opposite station.
Mind that all antennas of the modules are operated in the same operating position (e. g. all antennas are standing vertically).
Electrical devices like computers etc. can generate interference fields that reduce the range.
If not given otherwise, the limits of the ETSI EN 300 220 and ETSI EN 301 489 will apply.

Technical data

If not given otherwise, the limits of the ETSI EN 300 220 and ETSI EN 301 489 will apply.

Properties	**Value / description**
Dimensions L x W x H approx.	98 mm x 72 mm x 47 mm
Weight	approx. 270 g
Classification	SRD class 2, ISM band
Typ of modulation	GMSK
Frequency range	868 MHz
Receiver sensitivity	- 100 dBm @ BER 10 $^{-3}$
Transmitting power	7 dBm
Range	approx. 400 m in the free field
Operating temperature	- 15 °C to + 55 °C
Supply voltage	7 ... 12 V / 500 mA
Power supply socket	– ○–◉–○ +, outside Ø 3.5 mm, inside Ø 1.35 mm
Protection class housing version	IP20
Fuse	0,5 - 1 A
Antenna connection	SMA socket
Temperature range storage	- 40 °C ... + 85 °C
Interfaces	RS232: max. data rate 115.2 kbits/s USB: max. data rate 115.2 kbits/s

Table 8: General properties

Data rates of the radio module

User data length (Payload) in byte	**Confirmed connection with Acknowledge P2P** [2)]	**Unconfirmed connection Broadcast P2M** [3)]
1 (min.)	900 bit/s	1.4 kbit/s
16	11 kbit/s	16 kbit/s
64	25 kbit/s	33 kbit/s
245 (max.)	38 kbit/s	44 kbit/s

Table 9: Typical data rates (net) RS232

[2)] point-to-point connection
[3)] point-to-multipoint connectio

The measured values determined in table 9 are typical data rates over the RS232 interface.

Conformity

Declaration of conformity

Herewith, the FMN communications GmbH declares that the wireless measurement system complies with the essential requirements and the other relevant provisions of the directive 1999/5/EG (R&TTE directive). The complete declarations of conformity can be found in the Internet under http://www.fmncom.com.

Notes

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